# 17.0 COLUMBIA RIVER CHUM ESU

## 17.1 BACKGROUND

### 17.1.1 Description of the ESU

The Columbia River chum ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon (64 FR 14508; March 25, 1999). The Willamette/Lower Columbia River Technical Recovery Team (TRT) identified 16 historical populations within the ESU, segregated into three ecological zones (Table 1.) There are two primary naturally spawning populations, the Grays River population and the Lower Gorge Tributaries Population (Ives Island area) that have been self-sustaining, though at low levels until recently. Since 2001, numerous and more intensive spawning ground surveys and DNA sampling have occurred, and these evaluations have identified small naturally spawning populations in tributaries outside the two main spawning areas. Chum adults were observed in the majority of the Washington tributaries, but intensive surveys have not identified chum spawners in lower Columbia River tributaries in Oregon. There are three artificial propagation programs that are also considered to be part of the ESU (Table 1). NMFS has determined that fish from these programs reside within the historical geographic range of the ESU and do not exhibit substantial divergence from the local natural populations.

### 17.1.2 Current Status of the ESU

At least 88% of the historical populations appear to have been extirpated, or nearly so. The extant populations have been at low abundance for the last 50 years in the range where stochastic processes could lead to extinction. Encouragingly, there has been a substantial increase in the abundance of the two main production centers and the new (or newly discovered) I-205 population. However, it is not known if this increase will continue, and the abundance is still substantially below the historical levels. The BRT concluded that the ESU remains "likely to become endangered in the foreseeable future" (BRT 2003).

## 17.2 ASSESSMENT OF THE HATCHERY PROGRAMS

The following section presents a summary of artificial propagation programs in the Columbia River chum salmon ESU that release spring chinook salmon. The broodstock history, similarity between hatchery-origin and natural-origin fish, program design, and program performance are described by population as outlined in Table 17.1.

### 17.2.1 Grays River Chum Salmon Population

#### 17.2.1.1 The Sea Resources Chum Salmon Program

***17.2.1.1.1 Broodstock History***. The Chinook River program is within the geographic area occupied by the ESU, and the program is integrated with the Grays River population. Prior to 1996, chum salmon released at the Sea Resources Hatchery were from outside the ESU (Willapa

Bay). These releases were discontinued in 1996, and any returning chum salmon from these releases were removed from the naturally spawning population (2001). In 1999, chum salmon broodstock transplanted from the Grays River population were released into the Chinook River. This is a small program, releasing approximately 147,500 juveniles annually.

***17.2.1.1.2 Similarity between Hatchery-origin and Natural-origin Fish***. Genetic data for the Grays River population and hatchery returns to the Grays River (source of broodstock for Sea Resources program) indicate that the program fish have not diverged from the naturally spawning population (Small 2003). Currently, hatchery adult returns are being used for broodstock to sustain the hatchery program in the Chinook River, and surplus fish are released upstream to spawn naturally. Program chum salmon release timing and size are consistent with emigration traits observed for the naturally produced population.

***17.2.1.1.3 Program Design***. This is a conservation program with the primary purpose of increasing natural population viability in the Chinook River. Approximately 50 percent of the returns to the hatchery weir are passed upstream to spawn naturally. Spawned carcasses of chum retained for broodstock are planted in the watershed for nutrient enhancement. The hatchery program supports efforts to improve salmon habitat within the basin. This program started with the 1999 broodyear, and returns were first observed in 2002. Hatchery-origin chum salmon make up over 90 percent of the total returns, including escapement to the hatchery rack and fish released upriver to spawn naturally. Program fish are 100-percent otolith marked. This program applies the BMPs for a conservation program that are recommended by NOAA Fisheries.

***17.2.1.1.4 Program Performance***. Chum salmon from the Sea Resources program have been observed in the Grays River, Germany Creek, and Skamokowa River, though they account for less than 10 percent of the sampled fish. This is a new program, and smolt-to-adult returns of three-year-old fish from the 1999 brood were estimated to be approximately 1 percent (BRT 2003). The cohort replacement rate for this program has not been calculated. Sea Resources is a nonprofit education and restoration organization, and funding for the program is from grant money. There is strong support for this and the other programs at the facility, but future funding is not certain. The program operates a weir to collect broodstock and monitor adult escapement. These activities may cause a delay in adult upstream migration.

***17.2.1.1.5 VSP Effects***. The Sea Resources chum salmon program has increased the number of chum salmon spawners in the population, but the program is too new to determine if natural production will increase. The program has also increased the spatial distribution of the Grays River population by reestablishing chum salmon into the Chinook River. The program may be considered a genetic reserve for the Grays River chum population, providing an alternative broodsource for the population at a transplanted location.

### 17.2.1.2 Grays River Chum Salmon

***17.2.1.2.1 Broodstock History***. The Grays River chum salmon program planned to use chum salmon returning to a trap at the outlet of Gorley Springs as broodstock. The trap is below several artificial spawning channels that were to be used as part of the program. Fish were collected at this site until the winter/spring of 1999, when a high-water event destroyed the

spawning channels and trap. Currently, broodstock is collected from adults returning to the Grays River Hatchery and from chum salmon collected in the West Fork and mainstem Grays River. The production goal is 400,000 eggs, which requires approximately 160 chum adult pairs. This is a relatively new program started in 1997.

***17.2.1.2.2 Similarity between Hatchery-origin and Natural-origin Fish***. Analysis of genetic data collected from the Grays River population and hatchery returns to the Grays River indicated that the program fish have not diverged from the naturally spawning population (Small 2003). Currently, hatchery-origin and natural-origin adult returns are being used for broodstock. In 2002, 60 percent of the broodstock was hatchery-origin adults. In 2003, 40 percent of the broodstock was hatchery-origin adults (WDFW 2004). With this high proportion of natural-origin fish in the broodstock, it is not expected that these two populations would diverge in genetic or ecological characteristics. Program chum salmon have similar life history characteristics to those observed for the naturally produced population.

***17.2.1.2.3 Program Design***. This is a conservation program with the primary purpose of augmenting natural production in the Grays River. There are no fisheries in the Columbia River that target chum salmon. Carcasses from chum spawning at the hatchery are planted in the watershed for nutrient enhancement. This program follows the BMPs for a conservation program.

***17.2.1.2.4 Program Performance***. In 2003, program fish made up less than 10 percent of the natural spawning population in the Grays River (WDFW 2004). However, chum salmon from the Grays River Program were observed in Skamokawa Creek (five out of 65 sampled) and the Washougal River (one of fifteen chum sampled) (WDFW 2004). This is a new program started in 1997, with initial returns observed for the 1998 and 1999 broodyears in 2002 and 2003. Total survival rates for these broodyears have not been calculated. The Grays River chum salmon program is funded as part of the operation of Grays River Hatchery for production of coho for the Deep River and Steamboat Slough net pen terminal fisheries. These programs are funded by BPA, which also currently funds the monitoring and evaluation activities for the chum program. The intake for Grays River Hatchery does not meet current NOAA Fisheries screening criteria and could potentially cause high mortality among juveniles that encounter the screen. In addition, the intake structure is at risk of failing. Erosion near the intake, if not repaired, will cause a breach and shift the flow of the West Fork of the Grays River into another channel and away from the hatchery intake. An alternative site that is being considered for the program is WDFW's Beaver Creek Hatchery, which is located in the Elochoman River basin. This facility is currently mothballed and will need substantial funding to restart. This program could close if the Grays River changes course, or if additional funding is not obtained.

***17.2.1.2.5 VSP Effects***. This program has increased the number of naturally spawning chum for one of the two largest populations in the ESU. This program can act as genetic reserve, but only if the program is fully funded and improvements are made to the facility.

## 17.2.2 Lower Gorge Tributaries Population

### 17.2.2.1 Washougal/Duncan Creek Chum Salmon Program

***17.2.2.1.1 Broodstock History***. The Washougal/Duncan Creek program first released fish in 2002 and uses broodstock collected from the spawning grounds adjacent to Ives Island. This program is integrated with broodstock seined from the naturally spawning population. The production goal is 100,000 juveniles.

***17.2.2.1.2 Similarity between Hatchery-origin and Natural-origin Fish***. Program fish are released into Duncan Creek, a recently reestablished chum spawning tributary to the Columbia River about two miles below the main Ives Island spawning area upstream. Passage for migrating chum adults was provided, and spawning channels were reestablished and have proven successful in attracting chum adults. The program fish are derived from the naturally spawning population at Ives Island and are not expected to diverge from that population. Adults that enter Duncan Creek are also from this population. Genetic and life history data are currently being collected to evaluate the program.

***17.2.2.1.3 Program Design***. This is a conservation program primarily designed to increase the number of naturally spawning chum salmon in Duncan Creek as part of a habitat improvement project. Adults are collected and transported to Duncan Creek (65 in 2002 and 54 in 2003) to spawn naturally, and an additional number of adults are transported to WDFW's Washougal Hatchery for broodstock to produce juveniles for outplanting into Duncan Creek. The program also has a secondary purpose to act as a safety-net for the Ives Island, Hamilton Creek, and Hardy Creek natural spawners in years when low flows prevent access into the creeks and onto the spawning grounds around Ives Island. This safety-net feature has not been implemented to date.

***17.2.2.1.4 Program Performance***. The program is expecting its first returns in 2004. All of the production from the program has been given an otolith mark for identification upon adult return. This program is funded by BPA in response to a "reasonable and prudent alternative" included in the FCRPS 2000 Biological Opinion, and funding is therefore expected to continue into the future. The program also has a strong monitoring and evaluation component.

***17.2.2.1.5 VSP Effects***. This program has supported the reintroduction of chum salmon into historical habitat in Duncan Creek, and that is expected to increase the spatial distribution of the Lower Gorge Tributaries population of chum salmon. This is a new program, and thus it is unknown if the program will increase the abundance of chum salmon in this population. The program can act as a short-term safety net for the reference population during periods of very low flows.

## 17.3 CONCLUSIONS

**Existing Status**: Threatened
**BRT Finding**: Threatened
**Recommendation**: Threatened

## 17.3.1. ESU Overview

### *17.3.1.1 History of Populations*

The Willamette/Lower Columbia River (WLC) TRT tentatively identified 16 populations with the ESU (Myers et al. 2002). There are two extant populations: Grays River and Lower Gorge Tributaries. Historical populations include: Youngs Bay, Big Creek, Elochoman River, Clatskanie River, Mill-Abernathy-Germany, Scappoose Creek, Cowlitz River, Kalama River, Lewis River, Salmon Creek, Clackamas River, Sandy River, Washougal River, and Upper Gorge Tributaries. Increased sampling and hatchery returns have in recent years observed small numbers of chum salmon returning to the following populations: Big Creek, Elochoman River, Mill-Abernathy-Germany, Lewis River, Cowlitz River, and Washougal River.

### *17.3.1.2 Association Between Natural Populations and Artificial Propagation*

**Natural populations "with minimal genetic contribution from hatchery fish"**
Artificial propagation programs for chum salmon were not successful in the past and were discontinued in most areas by the 1960s. Of the two extant populations, only the Lower Gorge Tributaries natural population is likely to be subject to minimal genetic influence from hatchery-origin fish. There is a small re-introduction program with the area of the population (Duncan Creek chum salmon) that has only recently release juveniles and is located in a tributary away from the more abundant natural spawning aggregations.

**Natural[1] populations "that are stable or increasing, are spawning in the wild, and have adequate spawning and rearing habitat" [2]**
There are no populations that meet this criteria. The Lower Gorge Tributaries chum salmon population has had a declining trend since the 1950s and has been at relatively low abundance up to 2000. However, abundance estimates for 2002 and 2003 have shown a substantial increase (BRT 2003).

**Mixed (Integrated Programs[3])**
The mixed (aggregate natural and hatchery-origin) chum salmon population in the ESU is Grays River.

**Hatchery (Isolated[4])**

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[1] See HLP for definition of natural, mixed and hatchery populations

[2] HLP Point 3

[3] Integrated programs follow practices designed to promote and protect genetic diversity and only use fish from the same local population for broodstock (both natural-origin fish, whenever possible, and hatchery-origin fish derived from the same local population and included in the ESU). Programs operated to protect genetic diversity in the absence of natural-origin fish (e.g., captive broodstock programs and the reintroduction of fish into vacant habitat) are considered "integrated".

There are no isolated hatchery programs in the ESU.

## 17.3.2 Summary of ESU Viability

### *17.3.2.1 Abundance*

See Table 17.1 for a summary of abundance information. Estimated natural-origin returns and the total number of natural spawners (i.e., the combination of natural-origin and hatchery-origin chinook included in the ESU) have increased since 1999 when the ESU was listed as threatened. However, average total (aggregate natural and hatchery-origin chum salmon) escapements to natural spawning areas remains well below target abundance levels for all of the populations except in 2002 and 2003 for the two extant populations, and the Washougal River Population that includes naturally spawning chum in the mainstem Columbia River near the I-205 Bridge. Naturally spawning chum salmon have been supplemented by returns from the Sea Resources and Grays River programs. The Duncan Creek program is too new to provide adult returns.

### *17.3.2.2 Productivity*

The BRT (2003) did not identified productivity as a major risk. We are aware of no data indicating hatchery programs have increased ESU productivity.

### *17.3.2.3 Spatial Structure*

The spatial structure of the ESU was a major risk factor for the BRT (2003) due to the fact that only two of the 16 populations are extant. The spatial structure of the Grays River population has been increased by the Sea Resources chum salmon propagation program, which has re-established CR chum salmon into the Chinook River. The Lower Gorge Tributaries population has been increased by the Washougal/Duncan Creek program by supporting the re-introduction of chum salmon into Duncan Creek. However, these programs are only increasing the spatial distributions of the populations and not the ESU as a whole.

### *17.3.2.4 Diversity*

The integrated Sea Resources program has replaced a non-ESU chum salmon with one using chum salmon from within the population, this has reduced the risks to the Grays River population. The Washougal/Duncan Creek program has a safety-net feature that when implemented can reduce the risk of loss of diversity for the Lower Gorge Tributaries population.

## 17.3.3 Artificial Propagation Record

### *17.3.3.1 Experience with Integrated Programs*

The three chum salmon program are relatively new, all were initiated after 1999.

### *17.3.3.2 Are Integrated Programs Self-Sustaining*

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[4] Isolated programs do not follow practices designed to promote or protect genetic diversity. Fish that are reproductively isolated are more likely to diverge genetically from natural populations included in the ESU and to be excluded themselves from the ESU.

Currently the three programs appear to be self sustaining.

#### *17.3.3.3 Certainty that Integrated Programs will Continue to Operate*

The Grays River chum salmon program is funded indirectly by the BPA, which funds production at the Grays River hatchery for other programs (SAFE project net pens). BPA funds the monitoring and evaluation activities for both the Grays River and Washougal/Duncan Creek programs. These programs are funded through the Fish and Wildlife Program and go through periodic review and competition and could lose funding if priorities change or BPA reduces funding to the Fish and Wildlife Program. The Grays River program is at risk of catastrophic loss if current configuration of the hatchery water intake is not modified. River channel changes due to high flows could isolate the intake from the river. Modifications have been proposed but funding is not available. The Sea Resources program is funded through Federal and state grants and community donations, the future funding of this program is uncertain.

### *17.3.4 Summary of Overall Extinction Risk Faced by the ESU*

The overall abundance of the ESU has increased in the last two years, and more chum salmon are being observed in historic habitat. Artificial propagation programs have supported the increases in abundance for the Grays River population. The Washougal/Duncan Creek program is too new to evaluate. The Sea Resources program has decreased the risk to diversity by eliminating the release of non-ESU chum salmon. These artificial propagation programs have only supported natural populations that are already established and have not supported expansion into other historical population areas.

## 17.4 LITERATURE CITED


BRT 2003. West Coast Biological Review Team. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. July 2003. Northwest Fisheries Science Center. Seattle, WA.

Myers, J.M., and 10 co-authors. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-NWFSC-35. 443p.

Small, M.P. 2003. Lower Columbia River chum salmon (*Oncorhychus keta*) population genetic structure inferred from micosatellite DNA. Washington Department of Fish and Wildlife. October 23, 2003.

WDFW (Washington Department of Fish and Wildlife). 2004. Email from Joe Hymer to Richard Turner (NOAA Fisheries) May 13, 2004.

**Table 17.1**. Historical population structure and artificial propagation for Columbia River Chum populations.

| Ecological Zone | Historical Population | Artificial Propagation Programs with Historical Population | Included in the ESU? | Description | Program Release | Years initiated |
|---|---|---|---|---|---|---|
| Coastal | Youngs Bay | | | | | |
| | Grays River | Grays River Chum Salmon Program | Yes | Fry release | 400,000 | 1997 |
| | | Sea Resources Chum Salmon Program | Yes | Fry release | 147,500 | 1999 |
| | Big Creek | | | | | |
| | Elochoman River | | | | | |
| | Clatskanie River | | | | | |
| | Mill, Abernathy, Germany | | | | | |
| | Scappoose Creek | | | | | |
| Cascade | Cowlitz River | | | | | |
| | Kalama River | | | | | |
| | Lewis River | | | | | |
| | Salmon Creek | | | | | |
| | Clackamas River | | | | | |
| | Sandy River | | | | | |
| | Washougal River | | | | | |
| Gorge | Lower Gorge Tributaries | Washougal/Duncan Creek Chum Salmon Program | Yes | Adult and fry release | 100,000 | 2001 |
| | Upper Gorge Tributaries | | | | | |